



**National Aeronautics and
Space Administration**

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NRA-99-OES-09

RESEARCH ANNOUNCEMENT

**SENSOR INTERCOMPARISON AND MERGER FOR BIOLOGICAL AND
INTERDISCIPLINARY OCEANIC STUDIES (SIMBIOS)**

Proposals Due January 30, 2000

OMB Approval No. 2700-0087

**SENSOR INTERCOMPARISON AND MERGER FOR BIOLOGICAL AND
INTERDISCIPLINARY OCEANIC STUDIES (SIMBIOS)**

**NASA Research Announcement
Soliciting Research Proposals for
Period Ending
January 30, 2000**

**NRA 99-OES-09
Issued December 2, 1999**

**Office of Earth Sciences
National Aeronautics and Space Administration
Washington, DC 20546**

NASA RESEARCH ANNOUNCEMENT

Soliciting Investigations Contributing to

SENSOR INTERCOMPARISON AND MERGER FOR BIOLOGICAL AND INTERDISCIPLINARY OCEANIC STUDIES (SIMBIOS)

1.0 PURPOSE OF THIS NASA RESEARCH ANNOUNCEMENT

The purpose of this NASA Research Announcement (NRA) is to solicit proposals for scientific investigations and activities contributing to the continuation of NASA's Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies (SIMBIOS) project (McClain and Fargion, 1999). Between 1996 and 2001, six major international satellite missions will be launched that are capable of providing routine global ocean color data. Several other experimental missions providing limited spatial and temporal coverage will also be launched. The global imagers involved (OCTS, POLDER on ADEOS-I and -II, SeaWiFS, MODIS on Terra and PM, MISR, MERIS, and GLI) are highly complementary in many important respects, but also exhibit significant differences in technical approach (e.g., sensor design) which have implications for calibration, atmospheric correction, and algorithm development and performance.

The goal of SIMBIOS is to promote the exchange of technical information and the development of methodologies needed to ensure data products of the highest quality and consistency across sensors, and to obtain the most extensive coverage possible from these missions. Specifically, the objectives are (1) to quantify the relative accuracy of the ocean color products from international missions, (2) to improve the level of confidence and compatibility among the products, and (3) develop methodologies for generating merged, improved level-3 products. The differences among the sensors and the derived products must be resolved or explained and sufficiently documented to allow future scientists to relate their measurements to those of the present suite of ocean color sensors in order to infer accurately trends in the marine biosphere and to understand its response to, and effect on, the global environment. By identifying trends and variability in the marine biosphere, SIMBIOS is an intermediate step within the larger objective of estimating ocean productivity and the role of the ocean in the global carbon cycle. Investigating the role of planktonic ecosystems in the global carbon cycle requires consistent time series of satellite observations of global ocean color. The products of SIMBIOS will therefore be used in research into the global carbon cycle, and SIMBIOS is consistent with the focus of the U.S. Global Change Research Program in carbon cycle science (NSTC, 1999).

This NRA solicits investigations in the areas of (1) satellite sensor characterization and calibration, (2) ocean bio-optical algorithm evaluation and development, (3) atmospheric correction algorithm evaluation and development, (4) field instrument calibration and in-situ measurement protocol refinement, and (5) data merger methodology development. The present announcement is for the selection of investigations to be carried out for a

period of 3 years. The total amount of funds available is approximately \$3.5 million per year for 3 years.

2.0 BACKGROUND

2.1 NASA's Earth Science Enterprise

NASA's Earth Science Enterprise (ESE) seeks to develop an understanding of the total Earth system and the effects of natural and human-induced changes on the global environment. The Biology and Biogeochemistry of Ecosystems and the Global Carbon Cycle constitute one of five major themes of the ESE Science Implementation Plan (NASA, 1999). Within this theme, specific goals of the ESE Plan are (1) to understand how terrestrial and marine ecosystems respond to and affect global environmental change, (2) to understand the past and present role of ecosystems in the global carbon cycle, and (3) to predict their future role under a variety of global change scenarios.

For marine ecosystems, ESE's goals are to understand the physical and biological controls on primary productivity, and to predict how environmental change will affect carbon storage and cycling in the ocean. To this end, the ESE Science Implementation Plan calls for the continuation of systematic global observations of marine primary productivity and phytoplankton biomass (as indexed by chlorophyll concentration). The approach is to acquire a multi-decadal, multi-sensor global ocean color data set, backed up by other remote sensing and *in-situ* measurements, process studies and models. These observations are being and will be provided by NASA missions and by other international space agencies within the near term (1-5 years), and plans are being developed to transition these observations to operational agencies in the longer term (5-10 years).

2.2 The SIMBIOS Project

The SIMBIOS project was initiated in 1997 to address specifically the challenge of merging ocean color data from different sensors. The assembly of multi-sensor data sets to produce a consistent time series spanning several decades calls for a strong emphasis on instrument calibration and intercomparison of data products. SIMBIOS relies on *in-situ* data (optical and biological properties of the ocean, and atmospheric measurements) for calibration of the satellite data and validation of derived products. As ocean color data become available, the SIMBIOS project conducts inter-comparisons of sensor characteristics, calibration, and retrieval algorithms. The SIMBIOS project supports the establishment of measurement protocols for obtaining *in-situ* data, the collection of data for initialization cruises in support of newly launched ocean color sensors, the maintenance of buoys, and systematic validation activities from ships and aircraft. It also supports the development, testing and implementation of data merger algorithms, as well as the international coordination of inter-calibration and inter-comparison activities. Additional information on the SIMBIOS project is given in Appendix A.

3.0 RESEARCH TOPICS FOR REQUESTED PROPOSALS

This NASA Research Announcement solicits proposals that address the following topics:

- **Satellite sensor calibration and characterization**
- **Field instrument calibration and *in-situ* measurement protocol refinement**
- **Algorithm evaluation and development for:**
 - Atmospheric correction algorithms**
 - Ocean bio-optical algorithms**
- **Data merger methodology development and evaluation**

Proposals may include elements associated with more than one topic, but must clearly delineate the work and budget for each topic. Each topic is described in greater detail in the following sections.

3.1 Satellite Sensor Calibration and Characterization

SIMBIOS sensor calibration activities are conducted to ensure that changes or trends in the measured top-of-atmosphere radiances are due to actual changes in the ocean or atmosphere, and not the result of changes in the performance of individual instruments. A calibration program includes both pre-launch and on-orbit components, and can include direct and indirect (vicarious) methods.

The purpose of the SIMBIOS calibration program is to review pre-launch and on-orbit calibration data provided by the individual instrument projects, to complement (but not duplicate) the calibration activities of the projects, and to integrate various calibration data sets to provide the best calibration and algorithm coefficients possible, including uncertainties (Riley and Bailey, 1998). The SIMBIOS Project Office will request and exchange pre- and post-launch calibration data from the various ocean color sensors and make these data available to SIMBIOS principal investigators selected under this NRA.

The top priority is for calibration activities that relate signals from more than one of the sensors, since an important SIMBIOS goal is the development of a data set consisting of a long-term time series of calibrated radiances extending across the boundaries of individual missions. Selection of the proposals will be made in view of existing and planned calibration activities, and preference will be given to proposals that extend and complement those activities.

Particular attention will be paid to data delivery, which must be made in a timely manner, especially during the short initial phase of the missions when in-orbit calibration of newly-launched sensors is established. Preference will be given to investigations that (1) propose vicarious methods with emphasis on long-term time series, and (2) establish the traceability of required data sets or data collection activities to NIST radiometric standards. *In-situ* ocean and atmospheric measurements should be integrated with calibration round-robins.

Relevant topics pertaining to ocean color satellite sensor performance at ultraviolet, visible, and near-infrared wavelengths include, but are not limited to, the following:

1. On-orbit calibration stability of one or more satellite sensors on time scales ranging from within an orbit to several years
2. Cross-calibration of two or more satellite sensors over time
3. Characterization and correction of the effects of stray light, electronic crosstalk, and electronic overshoot off nearby bright targets (e.g., clouds, land, and ice)
4. Characterization and correction of nonlinearities in sensor response, e.g., scan modulation, temperature dependence, and polarization
5. Characterization and correction of out-of-band response
6. On-orbit or vicarious calibration of the sensor-atmosphere system

Calibration methods of interest may include, but are not limited to, the use of uniform land or water sites, optically thick clouds, and other targets of known (*i.e.*, measured) optical properties. These activities may involve radiometric measurements from high-altitude aircraft at the time of satellite overpass.

3.2 Field Instrument Calibration and *In-situ* Measurement Protocol Refinement

Accurate algorithms and validation data sets rely on accurate bio-optical and atmospheric measurements. Initial methodologies and guidelines for many such measurements were defined in the SeaWiFS protocols (Mueller and Austin, 1992, 1995), and the SeaWiFS and SIMBIOS Projects have supported a number of calibration and data analysis round-robins (Johnson et al., 1998 and 1999; Riley and Bailey, 1998) and protocol experiments (Hooker et al., 1999) to address some of these issues. However, there remain many questions about reliability and accuracy of a number of these measurements, e.g., above-surface reflectance and pigment absorption, which are pertinent to the objectives of SIMBIOS. Without well-conceived experiments designed to address specific issues, measurement errors in these techniques, including those associated with data processing, will remain unresolved. Also, there may be topics not covered in the existing protocols that need to be included and quantified. Therefore, proposals are being solicited that address the following:

1. Refinements in marine optical (inherent and apparent) property protocols
2. Refinements in atmospheric optical measurements relevant to validation of atmospheric correction
3. Refinements in data processing techniques for computation of relevant bio-optical and atmospheric correction parameters
4. Refinements in calibration techniques (field and laboratory)

It is expected that the SIMBIOS Project will continue to conduct a calibration round-robin similar to that of Riley and Bailey (1998). The SIMBIOS program does not have the budget to underwrite technology development. Thus instrumentation development proposals will not be considered, although simple and relatively inexpensive modifications to existing instrumentation will be considered. Finally, because the

existing protocols need to be periodically updated, proposals to assume that responsibility will be entertained, with the expectation that only one would be selected. Revisions to the existing protocols will be published as a formal SIMBIOS technical memorandum after approval by the SIMBIOS Project Office.

3.3 Algorithm Evaluation and Development

Validation is the process of determining the spatial and temporal error fields of a given bio-optical algorithm and data product. The SIMBIOS data product validation activities are solicited to provide (1) improvements in the accuracy of the atmospheric correction and (2) the spatial and temporal error fields of biological data products. Each is described more specifically in sections 3.2.1 and 3.2.2 below. In addition, proposals to combine the atmospheric correction and bio-optical algorithms into a single inversion procedure are solicited. The identification and elimination of biases between regions and between ocean color data sets, particularly those from SeaWiFS, MOS, POLDER, MODIS (Terra and PM), MISR, MERIS, and GLI, is a primary objective of the SIMBIOS program.

Every ocean color instrument has a validation program, but resources usually do not allow for complete validation of products over the full range of oceanic and atmospheric conditions expected to be encountered globally. To obtain observations in a cost-effective manner, proposers are encouraged to make best use of interagency and international collaborations, sharing of validation data, ships of opportunity, and increased participation and sharing of responsibilities by non-mission programs. Proposers are encouraged to submit proposals that (1) augment existing and proposed programs (rather than initiate new and independent programs), (2) establish the traceability of required data sets or data collection activities to NIST radiometric standards and the ocean optics measurement protocols, (3) utilize portable field sources (e.g., the SeaWiFS Quality Monitor) to monitor changes in instrument performance during data collection in the field, and (4) include participation in the instrument and analysis round-robins hosted by the SIMBIOS Project Office (McClain and Fargion, 1999).

Proposers are encouraged to submit proposals for focused validation activities which are required for understanding regional differences between sensor products. For example, more extensive data sets from very poorly sampled regions (e.g., high latitudes, highly oligotrophic regimes, and areas contaminated with mineral dust) are needed.

Proposers are also encouraged to consider time series observations in locations with significant seasonal variations in atmospheric and/or bio-optical properties, because time series (routine cruises, moorings, platforms) provide a diverse data set necessary for validation. Stationary time series provide information on the temporal domain, but can be obtained only for a few locations. A coordinated data collection system like NOAA/WMO SST buoy network does not exist for ocean bio-optics and biogeochemistry. On the other hand, time series of sun photometer data are routinely collected at a wide variety of sites as part of the Aerosol Robotic Network (AERONET)

which are being used to evaluate atmospheric correction algorithms. New techniques should be considered to maximize *in-situ* global coverage, *e.g.*, drifters, towed instruments, autonomous platforms and buoy systems. Proposals for innovative validation projects in these areas are encouraged, although verification of instrument calibration stability must be rigorously addressed.

3.3.1 Atmospheric Correction Algorithms

The vicarious calibration of the visible and near infrared bands as well as the accuracy of the bio-optical products are strongly dependent on the accuracy of the atmospheric correction. It is also important to note that useful atmospheric products, *e.g.*, aerosol radiance and optical thickness, can be derived from most ocean color data sets and these too depend on the correction schemes. The SIMBIOS Project has added ten coastal and island sites to the AERONET. Also, the Project has a number of handheld (MICROTOPS, SIMBAD) and two PREDE sun photometers which are available to SIMBIOS Science Team members on a temporary basis during field studies (McClain and Fargion, 1999). Specific areas of concern related to atmospheric correction algorithm performance include:

1. Detection and/or corrections for strongly light absorbing aerosols
2. Performance of algorithms in turbid (“case 2”) waters
3. Quantification and correction for whitecap and sun glitter effects
4. Verification of atmospheric corrections at high solar zenith angles
5. Effects of surface roughness on surface reflectance and feedback on atmospheric scattering

3.3.2 Ocean Bio-optical Algorithms

Basic protocols have been written for many of the bio-optical measurements needed for both calibration and validation (Mueller and Austin, 1993 and 1995). These should be reviewed with respect to application to all sensors and products of importance. The SeaWiFS and SIMBIOS Projects support the SeaBASS data archive and storage system which contains the bio-optical data collected by these two projects. These data are available to the SIMBIOS Science Team according to the data policy described in Appendix B.

Validation activities should be focused on data products such as the following:

1. Water-leaving radiance
2. Chlorophyll-*a* concentration
3. Phycoerythrin concentration
4. Concentration of other pigments and degradation products
5. Diffuse attenuation coefficient
6. Photosynthetically active radiation
7. Suspended sediment concentration
8. Coccolith concentration

9. Absorption coefficients and colored dissolved organic matter (CDOM)
10. Chlorophyll-*a* fluorescence and fluorescence yield
11. Ocean primary productivity

Specific areas of concern related to bio-optical product validation include:

1. Performance of bio-optical algorithms at high latitudes
2. Performance of algorithms in turbid (“case 2”) waters
3. Performance of algorithms in very low chlorophyll ($< 0.1 \text{ mg/m}^3$) waters
4. Performance of algorithms in very high chlorophyll ($> 10 \text{ mg/m}^3$) waters

3.4 Data Merger Methodology Development and Evaluation

A strategy of NASA’s Earth Science Enterprise is to acquire a multi-decadal, multi-sensor global ocean-color data set for assessing variability and trends in marine ecosystems. The data set would consist of time series of key variables such as chlorophyll-*a* concentration, primary productivity, colored dissolved organic matter, and aerosol optical thickness. The interest is not only in time series, but also in regional-to-global data sets. In particular, coastal data sets are needed by fisheries managers, geologists, hydrologists, and state and local agencies that monitor water quality.

The objective of the data merging component of the SIMBIOS Project is to develop and test algorithms that can be applied operationally to merge data from different sensors. However, funding of large computer systems required for merging large data sets, for implementation and testing of algorithms using large data sets, or for routine data processing will not be considered. Such processing activities can be performed by the SIMBIOS Project Office which already has the computational capability for such processing. The Project Office will assist SIMBIOS Science Team members in executing such processing tasks.

Proposals are solicited to develop methods for combining data from various ocean-color sensors in order to produce improved level-3 products or create new level-3 products. The typical products can be regional or global, and they can characterize variability of coastal and/or open ocean ecosystems. The geophysical variables to be merged must be derived, at least in part, from commonly produced satellite ocean-color products, e.g., chlorophyll-*a* concentration, water-leaving radiance, $K(490)$, etc., using validated algorithms.

Individual satellite missions will provide a variety of level-1 to level-3 products. Some of the products (e.g., chlorophyll-*a* concentration) will be similar for many missions, but there may be systematic differences depending on sensor characteristics and the algorithms used. Combining data from multiple sensors has the potential to improve level-3 products because it affords improved spatial and temporal coverage (Yoder et al., 1999). However, there are other potential advantages for combining data. For example, the polarization and bi-directional measurements of the POLDER instrument are

expected to provide a better determination of aerosol properties. Thus, an aerosol variable derived with POLDER might be used to improve the atmospheric correction for another sensor. Also, combining data from different sensors will give rise to new products. For instance, observations of the same variable at different times of day by different sensors would provide better daily averages and better temporal resolution of diurnal cycles.

Responsive proposals should combine data from at least two ocean color sensors, and can make use of level-1, level-2, and/or level-3 products directly. The solicitation is restricted to the development and testing of algorithms for operationally merging data. The SIMBIOS Project Office will implement the operational processing, and, thus, proposals to do operational processing elsewhere will not be considered responsive.

The proposals should identify the necessary data sets and their availability, and describe the procedures used to account for differences between the data sets to be combined or merged. The creation of diagnostic data sets to ascertain where the differences occur (navigation, radiometric calibration, atmospheric correction, bio-optical algorithm, space and time binning, etc.) may be necessary. Proposers should specify the delivery schedules and envisioned interactions with the SIMBIOS Project Office, and indicate wherever possible, how they can accommodate the inevitable changes that will occur in satellite launch dates, the overall merger methodology, and the ocean optics protocols.

4.0 Guidance for Proposers

This NRA solicits proposals for scientific investigations that are consistent with the objectives of the SIMBIOS project as detailed above, and that meet other requirements that are listed in the appendices. The proposal should provide sufficient detail to enable a reviewer to assess the value of the proposed research, and the probability that the investigators will be able to accomplish the stated objectives within the requested resources and schedule. Appendix A contains a detailed description of proposal contents and format specific to this NRA, and general guidelines for all NRAs are given in Appendix C.

Awards will be made for a period of three years to proposals that are approved under the terms of this announcement. NASA reserves the right to cancel this NRA if adequate funds are not appropriated.

4.1 Contractual Requirements

Each selected proposal will be supported under a contract (not a grant) between the PI's institution and NASA GSFC. All contracts must comply with the following items:

- Quarterly status reports
- Year-end Technical Memoranda (see McClain and Fargion, 1999)
- Yearly participation at Science Team meetings and activities

A summary research task schedule with delivery items identified is a mandatory requirement before contracts are awarded. Identifying delivery items in the proposal will facilitate the negotiation by the procurement office.

Investigators proposing **field work or any data measurements** will be required to identify:

- Minimum number of field campaigns proposed each year, minimum number of individual stations in each campaign, and proposed measurements.
- Methods used to acquire, process and analyze data and proposed calibration schedule. Measurements and instrument calibration methods shall follow protocols accepted within the SIMBIOS Science Team (Hooker et al., 1999; Johnson et al., 1998; Mueller and Austin 1992 and 1995). All instruments used must be calibrated at least two times per year or more frequently where required.
- The delivery schedule for data collected from each campaign. Maximum time allowed for delivery is 6 months for *in-situ* biogeochemical and optical measurements. A final data submission of all data collected during the field campaign is required by the end of the contract.

Investigators proposing **theoretical work or any algorithm development** must clearly identify incremental research tasks with proposed delivery times. Delivery items listed in the research task schedule should include:

- Special Topic Memoranda describing the accomplishments and status, delivered at least two times per year (these documents are for internal use by the project)
- Final algorithms developed and software, if applicable, including documentation

Past SIMBIOS contract delivery items are described in McClain and Fargion (1999).

All funded investigators must comply with the SIMBIOS data policy as described in Appendix B, although *a more open data policy is strongly encouraged*. Data formats and cruise reports must comply with SeaBASS guidelines and submission protocols (see guidelines at <http://seabass.gsfc.nasa.gov/~seabass/seabass/html/seabass.html>; Hooker et al., 1994). Cruise reports must include instrument technical information and calibration history.

Timely updates to the schedule of the cruise activities must be provided to the SIMBIOS Project Office, and changes in cruise schedule must be discussed with and approved by the project office.

Security. Proposals should not contain security classified material. If the research requires access to, or may generate, security classified information, the submitter will be required to comply with U.S. Government security regulations.

4.2 Eligibility

Participation is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA centers, and other government agencies. In accordance with NASA policy as described in Appendix D, all investigations by foreign participants will be conducted on a no-exchange-of-funds basis, i.e., investigators whose home institution is outside the United States cannot be funded by NASA.

4.3 Letter of Intent

All prospective proposers are strongly encouraged to submit a letter of intent in response to this NRA. This will facilitate planning of the peer review process. The letter of intent should be submitted electronically to the URL: <http://www.earth.nasa.gov/LOI>. If the proposer does not have access to the Internet, a letter of intent should be faxed to 202-554-3024 with the following information:

- PI and Co-I names and addresses (including zip + 4)
- Title of proposal
- Telephone and fax numbers of PI
- Email address
- Brief summary of the proposed work (not to exceed 300 words)

4.4 Schedule

Letters of Intent should be submitted by **December 29, 1999**. Proposals may be submitted at any time during the period ending **January 30, 2000**. Proposals submitted to NASA will be evaluated using scientific peer review. Proposals selected for funding will be announced in **May, 2000**. Projected contract start date is **December 1, 2000**.

4.5 On-line References

For more information pertaining to this NASA Research Announcement see:

- (1) NASA Research Opportunities <http://www.earth.nasa.gov/nra/index.html>
- (2) SIMBIOS Program and Project <http://simbios.gsfc.nasa.gov>
- (3) SIMBIOS Project 1998 Annual Report, *NASA Tech. Memo. 1999-208645*, NASA Goddard Space Flight Center, Greenbelt, Maryland, 105 pp.
(<http://simbios.gsfc.nasa.gov>)
- (4) IOCCG publications for present and future ocean color sensors
<http://www.ioccg.org/general.html>
- (5) SIMBIOS Project sun photometers see “Instruments “ at <http://simbios.gsfc.nasa.gov>

5.0 INSTRUCTIONS FOR SUBMITTING PROPOSALS

Identifier **NRA 99-OES-09**

Submit Proposals to: SIMBIOS NRA (NRA 99-OES-09)
Code YS
400 Virginia Avenue SW, Suite 700
Washington, D.C. 20024

For overnight delivery purposes only, the recipient telephone number is (202) 554-2775

Copies required: 10

Selecting Official: Director, Research Division
Office of Earth Science
NASA Headquarters

Obtain Additional Information From: Dr. John Marra
Code YS
NASA Headquarters
Washington, D.C. 20546-0001
Phone: 202-358-0310
Fax: 202-358-2770
Email: jmarra@hq.nasa.gov

Please use identifier number NRA 99-OES-09 when making an inquiry regarding this Announcement. Proposals submitted to NASA Headquarters will cause a delay, therefore, please adhere to "Instructions for Submitting Proposals" noted above. Your interest and cooperation in participating in this opportunity are appreciated.

ORIGINAL SIGNED BY:

Ghassem R. Asrar
Associate Administrator
Office of Earth Science

APPENDIX A

ADDITIONAL INFORMATION AND GUIDANCE ON PROPOSAL FORMAT AND CONTENTS

A.1 Scope of the SIMBIOS Project

The SIMBIOS project was initiated in 1996 with the formation of the SIMBIOS Project Office and the release of the first SIMBIOS NRA (NRA-96-MTPE-04); the Project Office and Science Team activities began in 1997. The SIMBIOS project incorporates aspects of instrument (*in-situ* and satellite) calibration and measurement accuracy determination, algorithm development and evaluation, product merging, data processing, and interagency and international coordination. The Project Office integrates information from and provides feedback to each instrument project. The SIMBIOS project has fostered collaborations with other space agencies and science working groups to assist each instrument project (e.g. MOS, OCTS, POLDER, SeaWiFS, and MODIS) in achieving its objectives (McClain and Fargion, 1999; Wang and Franz, 1998, 1999).

The SIMBIOS project supports the collection of systematic *in-situ* observations at a number of sites for objectively comparing ocean color satellite derived products and for testing vicarious calibration methodologies. The field measurements include *in-situ* ocean and atmospheric optical properties, and ocean biological measurements. The approach presently being used by the SIMBIOS project is to derive level-2 data using a software package (MSI12) (Wang, 1999) which is capable of processing level-1b data from multiple ocean color sensors using the standard SeaWiFS algorithms of Gordon and Wang (1994 a, b). Based on future findings of the SIMBIOS Project Office and the Science Team, other approaches may also be implemented.

A.2 The SIMBIOS Project Office

The SIMBIOS Project Office at NASA Goddard Space Flight Center provides support and coordination for the SIMBIOS project including administrative functions (e.g., annual meeting and workshop coordination, contract funding and monitoring, and instrument pool scheduling), project documentation (e.g., web page maintenance, and the annual project report), and data processing system and software support. Specifically, the Project Office is responsible for the following:

1. Assistance in the collection, processing, archiving and documentation of the calibration and bio-optical data sets. Calibration data sets include those associated with instrument and data analysis round robins, and pre- and post-launch sensor calibrations.
2. Maintenance of the SeaWiFS Bio-optical Archive and Storage System (SeaBASS; Hooker et al., 1994) for tracking instrument calibrations and validating bio-optical algorithms and merger methodologies with *in-situ* data.

3. Oversight of the regular revision of the ocean optics protocols (Mueller and Austin, 1992, 1995) which establish the methodologies and standards for calibrating instruments, collecting data, and producing final results from approved analysis procedures.
4. Assistance in data acquisition during major field studies. Assistance is in the form of satellite overflight predictions and real-time data products.
5. Assistance in satellite product validation and quality control assessment. Activities include satellite-*in-situ* data match-up comparisons and algorithm evaluations.
6. Assistance in the development, evaluation, and implementation of product merger schemes and algorithms.
7. Coordination of the annual Science Team meeting and of workshops concerned with specific issues important to the success of the SIMBIOS project.

A.3 International Coordination

The SIMBIOS project is represented at the international level by the International Ocean Color Coordinating Group (IOCCG). The IOCCG is an international group of experts in the field of satellite ocean color, which acts as a liaison and communication channel between users, managers, and agencies in the ocean color arena. The IOCCG was established following an endorsement by the Committee on Earth Observation Satellites (CEOS). The activities of the IOCCG are supported by financial contributions from NASA, the National Space Development Agency of Japan (NASDA), European Space Agency (ESA), Centre National d'Etudes Spatiales (CNES), Canadian Space Agency (CSA), and the Joint Research Centre of the European Commission (JRC). The IOCCG is an Affiliated Program of the Scientific Committee on Oceanic Research (SCOR), which also provides infrastructure support to the group.

The IOCCG report of Yoder et al. (1999) summarizes technical requirements for global-scale, operational and scientific remote sensing of ocean color (Case I and II waters) and addresses the issues of complementary data merging and validation. An open challenge is the achievement of data compatibility through definition of sensor-specific constraints on derived products and the development of methods for merging derived geophysical properties. Thus, data merging and product generation from multiple sensors should be part of the strategy, building on lessons learned from NASA's SIMBIOS program (Yoder et al., 1999).

A.4 Proposal Content and Format

The technical part of the proposal, including references, should be limited to the equivalent of 14 pages of text, single-spaced, with type no smaller than 12 pt. A reasonable number of figures and tables (generally, 5 pages or less) may be appended. The cover page, contents, abstract, management plan, data plan, description of facilities and equipment, cost plan, and short resumes need not count in the 14-page limit. Additional pertinent information (e.g., reprints, letters indicating the commitment of co-investigators and collaborators or international partners) may be added as appendices.

Cover Letter. Each proposal should be prefaced by a cover letter signed by an official of the investigator's institution who is authorized to legally bind the organization to the proposal and its content.

Proposal Cover Page. The proposal cover page should contain the following: a short, descriptive title for the proposed effort; the name of the proposing organization(s); names, addresses, telephone numbers, FAX numbers, electronic mail addresses, and affiliations of the Principal Investigator and all Co-Investigators; and a year by year budget summary, including a total for all years. An example cover page is provided in Appendix E.

Table of Contents (recommended length: 1 page). A table of contents listing the page numbers for key sections of the proposal, including the data, management, and cost plans should be provided.

Abstract (maximum of 1 page). The abstract should summarize the research proposed in one page or less. It should contain a simple, concise overview of the investigation, its objectives, its scientific approach, expected results, and the value of its results to the SIMBIOS project. It is very important that this abstract be specific and accurately represent the research to be conducted.

Project Description (maximum of 14 pages). The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the work plan, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. Deliverables should also be described.

Management Approach. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities, and arrangements for ensuring a coordinated effort and timely data delivery should be described. Describe relationship among all individuals supporting the proposed effort, including leadership roles and points of contact.

Personnel. (2-3 pages per PI or Co-I). It is expected that the PI will be responsible for contract compliance and delivery. A short biographical sketch of the PI, a list of principal publications and any exceptional qualifications should be included. Proposers should include previous work experience in the field of the proposal. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants,

together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

Facilities and Equipment. Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

Cost Plan for US Proposals Only. (recommended length: 1 page per budget year, 1 budget summary page, 1-2 pages of explanation/justification). A detailed cost plan must be provided for each year of the proposed effort. Costs should be broken down into all of the following categories that apply: salaries and wages (including staff-months and rates for all personnel), benefits, supplies, services, equipment purchases, data purchases, computer services, publication costs, communication, travel, miscellaneous/other and overhead. Any unusual requests for funds (e.g., computer, and expensive equipment) must be specifically justified. Contribution from any cost-sharing plan or other support for the proposed research should be detailed.

Justification for Purchase of Instruments. Investigators proposing to purchase instruments for deployment on SIMBIOS cruises must submit a separate appendix to their proposal which addresses the scientific needs of such a purchase. The appendix should include ample justification, and a separate budget with instrument specifications. The SIMBIOS Project Office has a separate fund under this NRA for instrument purchases. The current instrument pool will not be continued past the end of the existing three-year contracts. However, the hand-held sun photometers maintained by the SIMBIOS Project Office will remain available (McClain and Fargion, 1999).

Current and Pending Support. For other current projects being conducted by the principal investigator or proposed for funding, provide title of project, sponsoring agency, ending date, and amount of support received or requested.

APPENDIX B

SIMBIOS PROJECT *IN-SITU* DATA POLICY FOR THIS NRA

This policy covers data submitted to the National Aeronautics and Space Administration (NASA) SIMBIOS Project at Goddard Space Flight Center (GSFC) for inclusion in the calibration and validation data collection. Presently, such data are stored in the SeaWiFS Bio-optical Archive and Storage System (SeaBASS) (Hooker et al., 1994; McClain and Fargion, 1999). The purpose of SeaBASS is to ensure that a user-friendly, queriable database of *in-situ* and airborne bio-optical measurements is readily available to SIMBIOS Science Team members and to other approved individuals (members of other ocean color instrument teams, voluntary data contributors, etc.) for advanced algorithm development and data product validation purposes. In addition, SeaBASS contains a variety of data collected using different methods (e.g., subsurface and above-surface reflectance, HPLC and fluorometric chlorophyll *a*) which are useful for measurement protocol evaluation purposes (Mueller and Austin, 1995; Hooker et al., 1999). This policy supercedes the SeaWiFS Project 1991 policy (Appendix A in Hooker et al., 1993). All SIMBIOS investigators must comply with this SIMBIOS data policy, although *a more open data policy is strongly encouraged*.

Submission: Ocean color algorithm development is essentially observation limited, and rapid turnaround and access to such data are crucial for progress. Data obtained under SIMBIOS NRA contracts must be submitted no later than six months from collection. International SIMBIOS Science Team members and members of other ocean color instrument teams who are making suitable observations are encouraged to provide their data as well, in order to foster collaboration.

Formats and Metadata: Data should be provided in the currently agreed-upon format, along with relevant information describing collection conditions, instrument specifications, instrument performance and calibration, and statements of the data accuracy. The currently used data format specifications and examples are posted on the SeaBASS website (<http://seabass.gsfc.nasa.gov/~seabass/seabass/html/seabass.html>). The provider should use FCHECK, an automated format checker program, to test the format validity of SeaBASS data files via return email. Appropriate instrument information, cruise reports and calibration histories are expected from each data provider. For data providers under SIMBIOS contracts, submission of the above information is mandatory. Data values shall be in meaningful units (e.g., providing volts together with conversion coefficients and drift data is unacceptable). High level data sets, such as normalized water-leaving radiance spectra, are encouraged together with descriptions or citations of the procedures used to derive the values. Descriptions of data should be segmented into logical groupings, e.g., by station, date, parameter, etc. Data quality, calibration traceability and history, instrument drift, and sampling protocols may be in text format.

Future recommended format modifications may be proposed during SIMBIOS Science Team meetings and discussed for approval and implementation.

Data Delivery and Access: SIMBIOS Science Team members will be required to deliver data collected under SIMBIOS support to the SIMBIOS Project Office within six months of data collection. For a period of three years following data collection, access to the digital data will be limited to SIMBIOS Science Team members and other approved users as agreed upon by the SIMBIOS Project and data providers unless earlier access is granted by individual data providers. Data providers can declare their data sets available for open access anytime prior to the three-year anniversary. The SIMBIOS Project will grant access to international science team members on a case by case basis according to ongoing collaboration efforts. Other investigators from the ocean color community will be able to query SeaBASS for information about the data (i.e., parameters, locations, dates and investigators), but will not have access to the data itself. If they are interested in obtaining the data, they will be referred to the provider as appropriate. After the third-year anniversary of data collection, all "restricted" data will change to an "open" status, and a copy of the data will be given to NODC for distribution. Exceptions to this plan may be made with the approval of the SIMBIOS Science Team. For example, some special data sets for algorithm development may be made available to the research community without restrictions.

Use Conditions: Prior to the three-year data collection anniversary, users of data will be required to provide proper credit and acknowledgment of the provider. Citation should also be made of the data archive. Users of data are encouraged to discuss relevant findings with the provider early in the research. The user is required to give all providers of the data being used a copy of any manuscript resulting from use of the data prior to initial submission for publication, thus giving the data provider an opportunity to comment on the paper. The provider(s) shall have the right to be a named co-author. All users and providers are required to report to SeaBASS administration possible data errors or mislabeling found in the database.

Updates and Corrections: A major purpose of the SeaBASS database is to facilitate comparisons between *in-situ* observations (regionally, temporally, by technique, by investigator, etc.), as well as between *in-situ* and remotely sensed observations. Updates and corrections to submitted data sets are encouraged. Records will be maintained of updates and corrections; summaries of updates will be posted on a database board, and users shall be notified of the updates. It will be the provider's responsibility to ensure that the current data in the archive is identical to the data used in the provider's most recent publications or current research. At the end of the SIMBIOS contract, a final data resubmission or a written certification of data quality from the provider is mandatory.

Distribution: After receiving the final data, the SIMBIOS Project will forward the data at the appropriate time to NODC for open distribution. A courtesy citation, naming the provider and the funding agency, will accompany the data. The SIMBIOS Project will not be held responsible for any data errors or misuse. Data copyright is retained by the US Government.

APPENDIX C

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number

of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) **The following information** is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) Abstract. Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) Project Description.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) Management Approach. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) Personnel. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional

personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) Facilities and Equipment.

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) Proposed Costs (U.S. Proposals Only).

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award

recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) Security. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) Current Support. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) Special Matters.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) Renewal Proposals.

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations

and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals.** Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) **Evaluation Factors.**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) **Additional Guidelines** Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included (unless otherwise noted in the NRA). Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the non-U.S. participant is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) When a "Notice of Intent" to propose is required, prospective foreign proposers should write directly to the NASA official designated in the NRA and send a copy of this letter to NASA's Office of External Relations at the address in paragraph (l)(3) of this provision.

(3) In addition to sending the requested number of copies of the proposal to the designated address, one copy of the proposal, along with the Letter of Endorsement from the sponsoring non-U.S. government agency or funding/sponsoring institution must be forwarded to:

National Aeronautics and Space Administration
Code IY
Office of External Relations
(NRA Number)
Washington, DC 20546-0001
USA

(4) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement to the above address if endorsement is not possible before the announced closing date. In such cases, NASA's Office of External Relations should be advised when a decision on endorsement can be expected.

(5) Successful and unsuccessful non-U.S. proposers will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the sponsoring government agency or funding institution. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsoring agency or funding institution for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(6) Depending on the nature and extent of the proposed cooperation, this arrangement may entail:

(i) A letter of notification by NASA;

(ii) An exchange of letters between NASA and the sponsoring foreign governmental agency; or

(iii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) **Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

APPENDIX D

GUIDELINES FOR FOREIGN PROPOSALS AND PROPOSALS INCLUDING FOREIGN PARTICIPATION

- (a) NASA welcomes proposals from outside the U.S. However, investigators working outside the U.S. are not eligible for funding from NASA. Proposals from non-U.S. entities should not include a cost plan. Proposals from outside the U.S. and U.S. proposals that include non-U.S. participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the non-U.S. participant is proposing. The letter of endorsement should indicate that the proposal merits careful consideration by NASA; and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed. Sponsoring non-U.S. agencies may, in exceptional situations, forward a proposal without endorsement, if review and endorsement are not possible before the announced closing date. In such cases, however, the NASA sponsoring office should be advised when a decision on the endorsement is to be expected.
- (b) Successful and unsuccessful proposers will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the sponsoring government agency. Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of External Relations will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:
1. An exchange of letters between NASA and the sponsoring governmental agency; or
 2. A formal Agency-to Agency Memorandum of Understanding (MOU).

Revision date 10/25/99

APPENDIX E

1. Example of Cover Sheet

NASA Research Announcement 99-OES-09

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator:: _____

Department: _____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name

Institution & Address

Telephone & Email

Budget:

1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

2. Example of Second Cover Sheet

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i) *Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs*, and (ii) *Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail: _____ Facsimile: _____

2. Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The (*Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant "*) hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding \$ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

1. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (l)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

APPENDIX F

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimates for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

	A	NASA USE ONLY	
		B	C
1. <u>Direct Labor</u> (salaries, wages, and fringe benefits)	_____	_____	_____
2. <u>Other Direct Costs:</u>			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. <u>Facilities and Administrative Costs</u>	_____	_____	_____
4. <u>Other Applicable Costs:</u>	_____	_____	_____
5. <u>SUBTOTAL--Estimated Costs</u>	_____	_____	_____
6. <u>Less Proposed Cost Sharing</u> (if any) _____	_____	_____	_____
7. <u>Carryover Funds</u> (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. <u>Total Estimated Costs</u>	_____	_____	_____
9. APPROVED BUDGET	_____	_____	_____

APPENDIX F

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.
2. Other Direct Costs:
 - a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
 - b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
 - c. Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
 - d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
 - e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
 - f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.
3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.
4. Other Applicable Costs: Enter total explaining the need for each item.
5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.
6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.
7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period. Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).
8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.

APPENDIX G

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